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UNITED STATES OF AMERICA.

THE FLOODS

— IN —

PENNSYLVANIA,

MAY 31 AND JUNE 1, 1889.

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1889
Signed Loren Blount

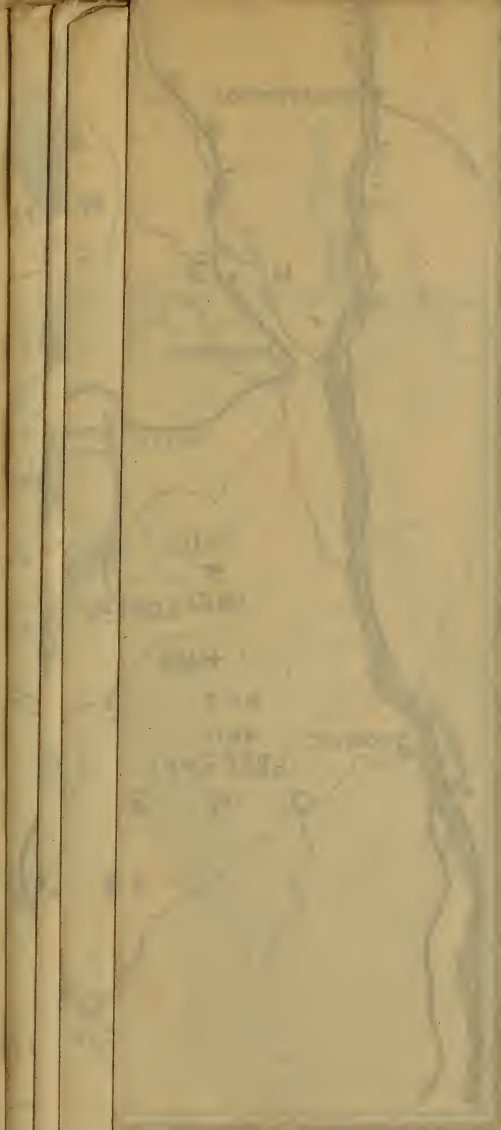
Advance Sheet from the Annual Report [1889] of THOS. J. STEWART,
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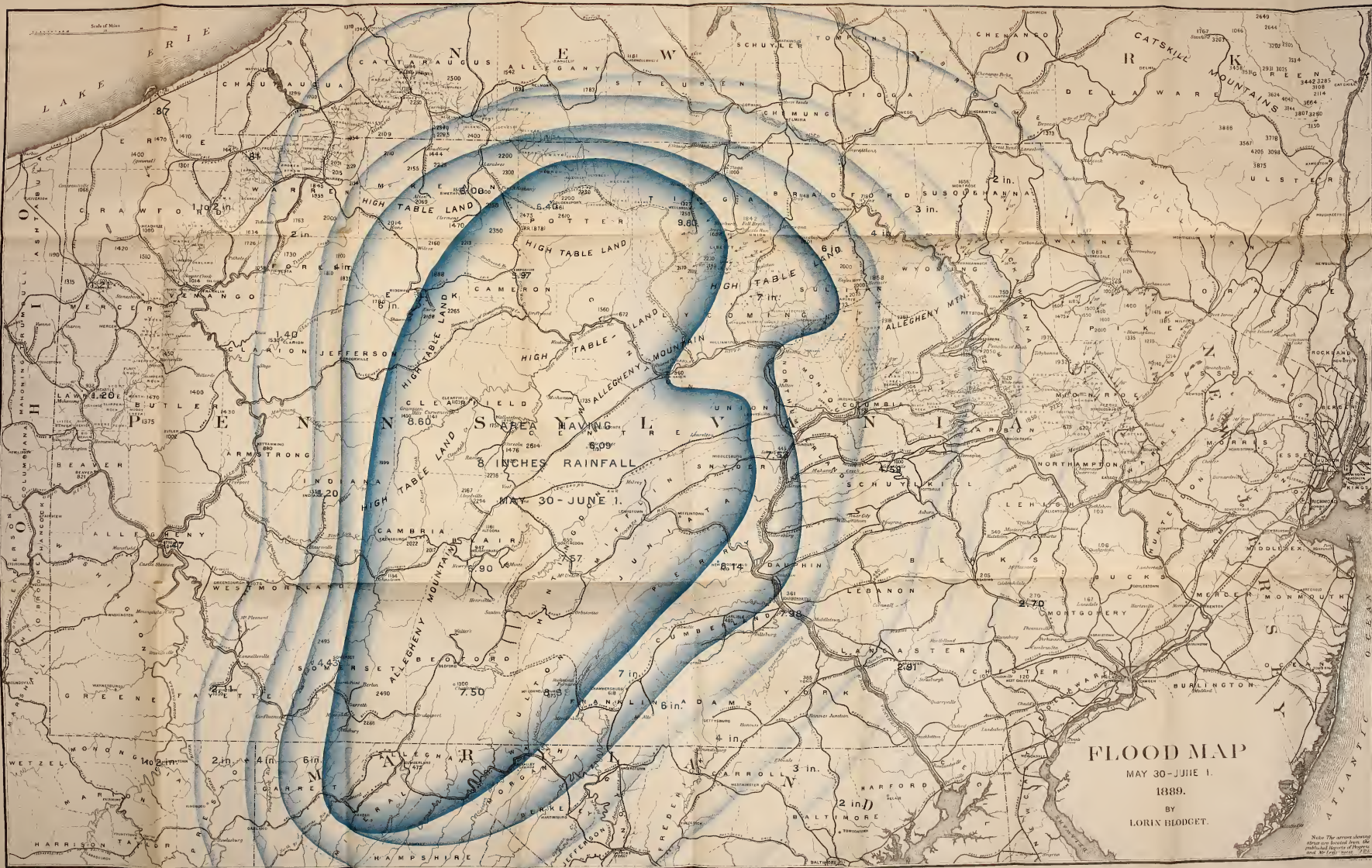
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THE FLOODS IN PENNSYLVANIA.

The destructive floods, caused by the unprecedented rainfall of May 30th to June 1st, in Pennsylvania, call for a brief report for the purpose of relieving the public mind as to the real character of these events, whether they resulted from accident, or from a great and unavoidable general calamity.

This greatest rainfall of the century in Pennsylvania, followed by the most destructive and general flood of modern times, came with ruinous effect on many counties of the State east of the mountains, as well as upon the immediate district drained by the Conemaugh valley. The fearful losses of life and property in this valley have no parallel in our history, and they have naturally received the chief attention of the public everywhere. The immediate cause being the breaking of the South Fork dam, it has been to some extent disconnected from the more general floods in the valleys tributary to the Susquehanna, yet such was the magnitude of the cause, as a whole, that it must be regarded as beyond human control. It is a public duty to define it as clearly as science may do, with all the observations at present available.

It was, in brief, a gigantic rainfall, amounting to an average of eight inches in depth of water, falling on an area of more than twelve thousand square miles, and covering the mountain plateau and its eastern declivities from Johnstown to Harrisburg, and extending northward from Somerset to McKean and Tioga counties. This area of greatest rainfall was oval in form, but broader toward the North Branch of the Susquehanna. Around this central body of flooded country the quantity fell off rapidly to six, four and two inches, although the highlands in Maryland and Virginia at the south, and in northeast Pennsylvania and southern New York had flooding rains of three to five inches in depth. The accompanying map shows approximately the conditions in Pennsylvania, but does not extend the illustration to the adjoining States. The change of quantity is of course not abrupt, but shades off gradually. At Pittsburgh there was only one and a-half inches, although in Ohio, Michigan and Indiana nearly three inches of rain fell on the 29th and 30th of May. There were flooding rains at the same time in Kentucky, Tennessee and West Virginia. In the southeastern counties of this State the rainfall was light, from half an inch to an inch only, although the southeast gale was even more violent there, and it swept Delaware and south Jersey with great force on May 31.

The appalling losses of life at Johnstown, of course, could not have resulted from any storm, however great the rainfall, yet it was apparent at Philadelphia on the afternoon of May 30, and during all the following day that the great heat and violent gale indicated a heavy rain fall in the interior of the State. Not knowing how great the violence was in the interior it was a surprise that more rain did not fall in the eastern counties, as in fact, it was a flooding storm at Washington and Baltimore during the entire day, May 31.

The general storm or stormy belt formed in eastern Kansas and Nebraska on May 28, moving eastward to Illinois, Indiana and Michigan on the 29th, and at the same time appearing in Kentucky and Tennessee. The whole area of four or five States experienced heavy and general rains, attended by much cold weather, with snow in Michigan and northern Indiana. There were severe frosts in New York and northern Pennsylvania, with fair weather, and in the south it was very cold, with some frosts, and finally snow fell near Chattanooga on the night of May 31. But as the storm was developed in Pennsylvania on May 30, it became very warm, especially in the southern counties, with cyclonic storms in West Virginia and Maryland, attended by much lightning and violent local winds. This condition prevailed in Virginia and at Washington. The 30th, being Decoration Day, the circumstances were very fully reported for that day, and also for the next day, because of the floods.

In the afternoon of the 30th the flooding rains began in the vicinity of Johnstown, and generally eastward to Harrisburg and Washington. Many writers and observers speak of them as the heaviest rains known to their experience; describe them as down-pours and cloud-bursts—and these generally continued for long periods, twenty-four to thirty-six hours. During these periods from four to eight inches of rain fell; in three or four cases more than eight inches, as the observations here given will show. All these measurements were in localities below the general level, and it is evident that much more fell on the higher points and mountain ridges—such greater quantity would more than make up the difference below eight inches as recorded in the valleys and given in the figures which follow.

It was this vast quantity of water that caused the flood, a flood so great as almost to break new channels of delivery, and shape the river beds anew. In former floods of nearly as great proportions there has usually been ice or snow to cause local obstructions, but there have been none to cover so much of cultivated surface or to bury the towns and cities near the rivers as this has done.

It is noticeable that the whole, or nearly the whole, period of heavy rainfall was attended by a south east wind, of greater or less severity. These points are given in the following tabular statement just as they were recorded by the observers of the State weather system. The

wind was not so severe in the central counties as it was in the southern and eastern part of the State, and as the rain ceased on the 31st, or morning of June 1st, the wind fell off to a calm, to be followed by a very light west wind, and very little change in temperature. The usual course is to find a high and cold west or northwest wind at the close of a general storm. There was also very little change on the barometric readings throughout the storm. A general depression of one-fourth of an inch is all that is reported, although there were no barometric records at the stations of the State weather system generally. The movements of the barometer did not attain the proportions usual in great storms, and there was therefore no sufficient warning derivable from that source. A general rain of moderate proportions was indicated, but nothing more.

Taking the entire area visited by heavy and general rainfall on May 28th to June 1st, there is no recorded experience approaching it in magnitude. In eastern Kansas and over much of Missouri, it reached an average of three inches. In Illinois and all the States intervening to Pennsylvania, the quantity varied from two to four inches; the observers of the several State weather systems reporting very fully. All their reports have been received and consulted in writing this paper. The States southward, including Tennessee, had general and heavy rains nearly equal to those just referred to. And while in the Ohio valley and vicinity of Pittsburgh there was less rain, the first mountainous elevations eastward were deluged with rains; the southern border having several destructive local storms or cyclones, such as are characteristic of the southern border of an area of general disturbance.

All the natural as well as artificial water-ways failed for drainage in this case, and they were more or less wrecked. The stream beds in some cases formed new channels, and farms that had been worked in security for a century were buried in the waste, and all ordinary embankments were washed away. The canals can scarcely be repaired at such cost as will be warranted by any present use of them. In some cases the position they were given will require to be materially changed. This wrecking of the canals is the most significant expression of the magnitude of the floods.

The purpose of this paper being to give an approximate measure of the storm and rainfall only, it is not practicable to include any specific report of losses, but such report should be made under due authority, and after careful examination of all the localities affected. It is evident from the simple statistics here given, that these floods were an overwhelming and unavoidable calamity; that the circumstances were exceptional and not usual, and that no adequate warning could have been given by State or National authority.

The occasion stands alone in history, and its equal may not occur

in another period of like duration with that elapsing since the first settlement of the State—not one century, but two centuries.

Measurement of Rainfall.

The following list of stations, furnishing reports to the Pennsylvania State Weather Service, gave returns of rainfall on each day during the storm, with the direction of the wind. They are grouped in general districts:

1st. West of the Mountains:

			May 30.		May 31.
Uniontown,	SE.	Winds.	0.00 Rain.	Calm.	2.67 In. Rain.
Mercersburg,	SE.	"	0.68 "	Calm.	0.33 "
New Castle,	SE.	"	0.10 "	SE.	1.20 "
Erie,	E SE.	"	0.32 "	SE SW.	0.41 "
Pittsburgh,	—	"	0.28 "	—	1.21 "
Indiana,	SE.	"	2.00 "	SE.	1.00 "
Johnstown,	—	"	—	SE.	2.40 "
Clarion,	SE.	"	—	SE SW.	1.40 "
Rimersburg,	SE.	"	(No guage.)	SE SW.	(No guage.)

2d. On the Plateaus:

Somerset,	SE.	Winds.	1.00 Rain.	SE NW.	3.43 In. Rain.
Charlesville,	S.	"	0.61 "	S SW.	6.71 "
Altoona,	—	"	—	SE.	3.03 "
McConnellsburg, ...	E. high	"	1.23 "	E. high.	7.08 "
Hollidaysburg,	S.	"	0.39 "	SE. light.	5.12 "
Huntingdon,	NE E.	"	0.60 "	E SW.	5.41 "
Grampian Hills,	E SE.	"	0.23 "	E. light.	8.37 "
Emporium,	E SE.	"	0.12 "	SE. light.	5.85 "
Coudersport,	S. & calm	"	—	E. light.	5.40 "
Smethport,	S. & light	"	0.02 "	SE. light.	5.50 "
Columbus, Warren Co.,	E SE.	"	0.07 "	SE SW.	0.74 "

3d. In the Interior Valleys:

Selinsgrove,	SE.	Winds.	0.46 Rain.	SE. gale.	6.00 In. Rain.
Phillipsburg,	SW.	"	0.50 "	NW. light.	2.83 "
Harrisburg,	—	"	0.20 "	SE. gale.	4.66 "
Carlisle,	E. high	"	0.05 "	SE. gale.	2.40 "
York,	E NE.	"	0.02 "	SW. high.	1.49 "
Lebanon,	SE.	"	0.02 "	SE. high.	2.50 "
New Bloomfield,	SE.	"	0.37 "	SE. high.	3.82 "
Myerstown, Lebanon Co., ..	E.	"	0.67 "	SE. gale.	1.08 "

4th. In the Northeastern Counties:

Eaglesmere, Sullivan Co., ..	SE. gale winds.	0.36 Rain.	SE. gale.	5.17 In. Rain.	
Wysox, Bradford Co.,	SE S. gale	0.32 "	SE. high.	2.90 "	
Wellsboro', Tioga Co.,	—	0.65 "	SE.	1.70 "	
Dyberry, Wayne Co.,	SE S.	0.11 "	SE.	0.35 "	(More in night.)
Honesdale,	—	0.07 "	—	0.50 "	
Girardville, Schuylkill Co., ..	—	0.61 "	E.	0.93 "	
Bethlehem, North'n Co.,	SE.	0.00 "	SE. high.	0.24 "	

5th. In the Southeastern Counties:

Lancaster,	E SE. Winds.	0.23 Rain.	SE. gale.	0.50 In. Rain.	
West Chester,	E SE.	0.00 "	SE. gale.	0.50 "	(Night, 1.50.)
Coatesville,	SE high	0.01 "	SE. gale.	0.00 "	(Night, 1.44.)
Swarthmore,	NE E.	0.00 "	SE. gale.	0.09 "	
Philadelphia,	SE.	0.01 "	SE. gale.	0.01 "	
Quakertown,	SE S.	0.01 "	SE. gale.	0.11 "	
Neshaminy, Bucks Co.,	NE SE.	0.04 "	SE. gale.	0.50 "	(In night.)
Pottstown,	SE.	0.00 "	SE.	1.70 "	
Reading,	SE.	0.00 "	SE. gale.	0.04 "	
Point Pleasant,	SE.	0.05 "	SE.	0.46 "	

In several cases these reports are imperfect. At Carlisle, York and Lebanon they are short of the full quantity, and as these measurements do not include the quantity falling on the night of May 31, and early morning of June 1st, there are considerable additions required to make up the total rainfall. In West Virginia and southwestern Pennsylvania the rain began May 30 at 12 M. to 3 P. M., continuing to the close of the next day, 10 or 11 P. M.; but at all points east of the mountains, as at Bedford, Altoona, Lewistown, York, Harrisburg, etc., the rain continued until the morning of June 1, 3 to 7 A. M. The quantities falling during the night do not appear in the above table, and in many cases they were not sent forward with the reports for May, but have now been received nearly or quite complete for June, and are given in a somewhat different form in the following tables, which are intended to afford the best practicable outline of the storm as a whole, and especially of its extension eastward.

The stations west of the flooded districts did not represent any definite period of time, nor any large quantity of water falling: the 30th and 31st of May giving at Erie, 0.78 in.; Greenville, 1.21 in.; New Castle, 2.25 in.; Pittsburg, 1.50 in.; Clarion, 1.40 in.; Columbus, Warren county, 0.83 in. For the flooded districts the following list of complete quantities for the entire three days can be given:

Indiana,.....	began	May 29th.....	ended	P. M., May 31,	4.20 inches.
Somerset,	"	P. M., 30th....	" 8	P. M., May 31,	4.43 "
Uniontown,....	"	8.50 P. M., 30th....	" 8.30	A. M., May 31, 12 hours,....	2.07 "
Johnstown,	"	3 P. M., 30th....	" 8	P. M., May 31, 26 "	...3.50 "
Altoona,	"	3 P. M., 30th....	"	P. M., May 31, 30 "	...5.33 "
McConnellsburg,.....	"	4 P. M., 30th ..	" 12	M., May 31, 32 "	...8.99 "
Charlottesville,	"	8 A. M., 30th....	" 9	P. M., May 31, 36 "	...7.60 "
Huntingdon,	"	4 P. M., 30th....	" 2	A. M., June 1, 34 "	...7.50 "
Chambersburg,.....	"	2 P. M., 30th....	" 3	A. M., " 36 "	...Not mes'd.
Lewistown,	"	4 P. M., 30th....	" 2	A. M., " 34 "	... "
Siglerville,	"	3 P. M., 30th....	" 1	A. M., " 34 "	... "
York,	"	2 P. M., 30th ..	" 5	A. M., " 34 "	...3.21 inches.
Harrisburg, .	"	5 P. M., 30th....	" 3	A. M., " 34 "	...8.20 "
Holidaysburg,	"	3 P. M., 30th....	" 3	A. M., " 36 "	...6.10 "
Grampian Hills,	"	4.30 P. M., 30th....	" 11.20	P. M., May 31, 32 "	...8.60 "
Williamsport,	"	9 P. M., 30th....	" 5	A. M., June 1, 32 "	...Not mes'd.
Ralston, (N. of Wms'p't.),	"	1 A. M., 31st	" 12	M., " 32 "	... "
Muncy, (E. of W'ms'p't.),	"	3 A. M., 31st ..	" 1	P. M., " 34 "	... "
Emporium, Cameron co.,	"	5 P. M., 30th....	" 11	P. M., May 31, 32 "	...5.97 inches.
State College, Centre co.,	"	3.30 P. M., 30th....	" 5	A. M., June 1, 37 "	...5.04 "
Phillipsburg,	"	4 P. M., 30th....	" 3	A. M., " 35 "	...6.09 "
Coudersport, Potter co.,	"	— P. M., 30th....	" 12	P. M., May 31, 30 "	...5.40 "
Selins Grove, Snyder co.,	"	— P. M., 30th....	" 3	A. M., June 1, 33 "	...7.53 "
New Bloomfield, Perry county,	"	— P. M., 30th....	" 3	A. M., " 33 "	...6.14 "
Smethport, McKean co.,	"	— P. M., 30th....	" —	A. M., " 30(?) "	...5.52 "
Lancaster. Lanc. co.,	"	6 P. M., 30th ..	" —	A. M., " 24(?) "	...2.91 "
Myerstown, Lebanon co.,	"	— P. M., 30th....	" —	A. M., " 24(?) "	...3.37 "
Catawissa, Columbia co.,	"	— P. M., 30th....	" —	A. M., " 28(?) "	...4.81 "
Eagles Mere, Sulliv'n co.,	"	— P. M., 30th....	" —	A. M., " 30(?) "	...5.53+ "
Girardville, Sch'lkill co.,	"	— P. M., 30th....	" —	A. M., " 30(?) "	...4.59 "

At all other points in Southeastern Pennsylvania the rain fell in the night of May 31, and early morning of June 1, at hours not closely observed, the quantity being recorded on the day last named only:

West Chester,	1.20 inches.	Swarthmore,	0.67 inches.
Kennett Square,	1.89 "	Philadelphia,	0.58 "
Coatesville,	1.03 "	Germantown,	0.51 "
Frederick,	0.98 "	Smith's Corners,	1.02 "

Northward and eastward the quantities increase slightly, but there was no flooding excess at the regular stations in the northeastern counties. The following quantities were reported as falling in the last ten or twelve hours of the general storm, which continued to the morning of June 1 :

Pottstown,	2.70 inches.	Bethlehem,	1.03 inches.
Seisholtzville,	1.93 "	Quakertown,	1.06 "
Lansdale,	1.67 "	Dyberry,	1.17 "
Doylestown,	0.88 "	Honesdale,	0.82 "
Point Pleasant,	0.95 "	Marshall's Creek (or Stroudsburg),	1.58 "
Reading,	2.05 "		

At Johnstown the rain is variously reported as beginning at 3 to 4 p. m., May 30, continuing to blow and rain all night very hard. It not only rained but it poured, as the keeper of the South Fork dam reports. Miss Ogle, the station observer at Johnstown, reported 2.3 inches of rain at 11 a. m., May 31; but a few hours later lost her life in the flood. There was evidently more than twice the quantity falling on the mountain water shed than that which fell at Johnstown, which is estimated at three to three and one-half inches.

The vast weight of water falling is shown by a calculation based on the weight of a cubic foot, thirty-five feet being a ton. In the surface of a square mile there would be 66,377 tons for an inch in depth, and 531,016 tons for a depth of eight inches. The quantity falling on 12,000 square miles, at this rate, is 6,732,246,000 tons. The force exercised by vast bodies of water in motion is irresistible.

The cloud stratum from which the rain fell moved slowly from a few points south of west, with less than the usual rapidity of general storms. It had a peculiar appearance, as of watery saturation, and the scud borne on the southeast wind beneath did not appear to add materially to the rainfall. The wind was one of aspiration, drawn beneath the cloud-body because of the rapid condensation, and not coming from the south or southeast for any considerable distance beyond the extent of the rain and the movement of the upper clouds from which it fell.

In all respects the conditions were the most remarkable and peculiar of those known to attend a general rainfall, and the vast masses of water thrown down over the surface of several States other than Pennsylvania, only add to the difficulty of explaining the origin of the storm, or the source from which so great a body of water can have been derived.

Floods in Maryland, Virginia and New York.

The overwhelming floods of the James and Potomac rivers in Maryland and Virginia are proof of the vast extent of the rainfall in that direction, but there are very few points at which any measurements have been taken. There was evidently a quantity equal to four inches of depth on the general surface in all the upland districts of those states, north of the latitude of Richmond.

The newspaper reports speak of much loss of life in the Potomac Valley and many of its tributaries, and of great losses to property and destruction of bridges. The Chesapeake and Ohio canal is reported to be almost completely ruined.

In New York State the Upper Allegheny river and its tributaries were flooded, the water coming from the Pennsylvania side chiefly. The Genesee river was flooded most destructively, the rains extending over two or three counties of that State, as well as on its upper branches in Pennsylvania. The upper branches of the North Branch of the Susquehanna were less affected, although there were great losses at Elmira and on several streams of that vicinity.

Further eastward the highlands of New York had heavy rains and much loss from floods. The Hudson was affected much more than usual and evidently the rains extended beyond it eastward, but not with local destructiveness.

In New England the rainfall was exhausted and it, did not reach the coast, although the southeast gale brought high water.

LORIN BLODGET.

PHILADELPHIA, *June 15th, 1889.*



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